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ABSTRACT

To validate a group phonics test designed to measure students' phonics knowledge, a study examined possible causal relationships of phonics knowledge and sight word recognition, sight word fluency, general reading fluency, and reading comprehension. Subjects, 95 first graders, 95 second graders, and 95 third graders chosen at random from 3 schools with low, average, and high socio-economic populations, were tested. Relationships between phonics knowledge and the other reading variables were analyzed using a cross-lagged panel analysis. Results indicated that: (1) scores from a group phonics test and an individual phonics test were significantly related; (2) reading pseudowords was more difficult for the subjects than identifying pseudowords when read to them; (3) both phonics tests measured phonics knowledge, but at different levels of understanding; (4) correlations of both phonics test forms suggest that both were significantly related to word recognition and reading comprehension; (5) phonics knowledge was related to word recognition, fluency of reading, and reading comprehension; (6) the ability to read pseudowords accurately and fluently was related to both word recognition and reading comprehension; (7) word recognition was related to reading fluency and comprehension; and (8) both phonics knowledge and word recognition abilities developed predictably as children moved up through the grades. (RS)

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Exploring Relationships Between Phonics Knowledge and Other Reading Related Variables

(Paper presented at the National Reading Conference, December 3, 1993)
Charleston, South Carolina

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Exploring Relationships Between Phonics Knowledge and Other Reading Related Variables

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Introduction

Currently both "whole language" and "skills-oreinted" educators are struggling with phonics issues. Phonics assessment is one of them. How can one best assess a student's phonics knowledge? It is generally recognized that there is a difference between a child's ability to recognize a word by sight and a child's ability to apply phonics skills to identify words not recognized by sight. Many attempts to measure phonics have been considered invalid because the instruments testing phonics used real words--casting doubt on whether the test tested phonics skills or sight vocabulary skills. Therefore, educators have concluded that an acceptable way to test phonics knowedge is to ask readers to read a list of nonsense words created according to the graphophonic structure of read words (Doehring et al., 1981; Jorm & Share, 1983).

When using nonsense words to assess phonics knowledge great care must be taken to use nonsense words that do not violate acceptable patterns of English orthography (Pikulski & Shanahan, 1980). I developed an individual phonics test where 81 nonsense words were created according to the graphophonic structure of real words (Eldredge, Quinn & Butterfield, 1990). In addition to testing all of the basic letter/sound relationships found in English orthography, my test also assessed a student's knowledge of letter/sound relationships within the four basic syllable patterns existing in the language. The sounds associated with letters are affected by the syllable patterns, and the test assessed a student's knowledge of letter/sound relationships within those basic patterns. However, this approach to testing phonics knowledge involved the use of an individually administered test, and one basic weakness of an individually administered test is inefficiency. Individual tests consume considerable teacher and classroom time.

I also developed a group phonics test based upon my individual test. Some educators suggest that the production tasks required to read nonsense words on an individual phonics test are more challenging for students than the recognition tasks required on a group phonics test (Pikulski & Shanahan, 1980). Others simply believe that group phonics tests are not very valid. However, since there is little evidence available to substantiate these beliefs, and little data to suggest how individual and group phonics

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measures are related, this study was conducted to validate the group test, and to discover how or if individual and group phonics measures are related.

Another phonics issue begging for more substantive data centers around the importance and specific benefits of phonics knowledge for students. For example, how does an individual's phonics knowledge affect other reading related variables and outcomes such as sight word recognition, sight word fluency, and reading comprehension? My colleagues and I explored the phonics/reading comprehension relationship with second graders using a traditional reading comprehension test (Eldredge, Quinn & Butterfield, 1990). We found that growth in reading comprehension, as measured by standardized test scores, was influenced by a student's graphophonic knowledge (phonics)--at least at the second grade level. We recommended that the study be replicated, at different grade levels, using less traditional measures of reading comprehension. Therefore, this study was conducted to examine possible causal relationships of phonics knowledge and 1) sight word recognition, 2) sight word fluency, 3) general reading fluency, and 4) reading comprehension in grades 1, 2, and 3.

Summary Statement of the Problem

Although there is currently a renewed interest in phonics among many educators, including some whole language advocates, there is also confusion regarding how that knowledge is used by students. There is also a critical need for more efficient approaches to test students' phonics knowledge. The specific purposes of this study were: 1) To validate a group phoncis test designed to measure students' phonics knowledge; 2) To find how group and individual phoncis measures relate to each other; 3) To determine if the production tasks on an individual phonics test are more difficult than the recognition tasks on a group phonics test; and 4) To explore possible causal relationships between phonics knowledge and other reading related variables: word recognition, word fluency, general reading fluency, and reading comprehension at grades one, two, and three.

Theoretical Causal Model to be Tested

It is hyphothesized that phonics knowledge has a causal impact on the reading comprehension of beginning readers. It is believed that for young readers the causal connection goes from phonics knowledge to sight word accuracy to sight word fluency to reading comprehension. First, phonics knowledge may influence growth in sight word recognition since there is increasing evidence that sight word learning is not a paired-associate memory process, but rather a process that involves remembering systematic connections between spellings and pronunciations o words (Ehri, 1992). Also, phonics

knowledge may be needed by students before they begin to recognize graphonphonic patterns in words (Ehri & Robbins, 1992), and once students begin to recognize familiar graphophonic patterns in newly encountered words, fewer printed exposures will be needed before they become recognized by sight. Second, the larger the sight vocabulary the more fluent the reading. A large sight vocabulary should impact reading fluency in two ways. It should increase fluency because the reader makes fewer stops to decode unfamiliar words. It should also increase fluency because the reader can probably use context clues to decode unfamiliar words. The use of context, the most efficient of the available word identification strategies, is dependent upon the size of the reader's sight word vocabulary. Third, the larger the sight vocabulary and the more fluent the word recognition, the better the comprehension. Students who are not preoccupied with decoding issues can give full attention to the process of constructing meaning.

Methodology

Subjects

The subjects for this study were 285 students (95 first graders, 95 second graders, and 95 third graders) chosen at random from three schools (schools with low, average, and high socio-economic populations).

Instruments

Phonics knowledge was tested using both an 81 item individual test and an 81 item group test. The group test and the individual test are comprised of three parts. Raw scores for each of the three parts, as well as a total score, were calculated for each student in the study from both tests. The individual phonics test was taped and timed. In addition to the raw scores, recognition efficiency scores (mean number of words read correctly per second) were determined for the total test and each subtest. Recognition efficiency scores (Stanovich, Cunningham & Freeman, 1984) were calculated by dividing the total number of words read correctly by the seconds taken to read them.

Sight word recognition was tested in two ways. First, sight word recognition was be tested using a 120 word test. All of the words on the test were taken from the Carroll, Davies, and Richman (1971) word frequency book. Thirty words are high frequency, regular graphophonic words; thirty are high frequency, irregular graphophonic words; thirty are low frequency, regular graphophonic words, and thirty are low frequency, irregular graphophonic words. The test was administered individually. It was taped and timed. The number of words read correctly in each test were calculated as well as the total number read correctly. Second, sight word recognition was tested by having the

students orally read a children's literature book appropriate for their grade level. The book was analyzed to determine the number words in the book. The students read the book orally. Their readings were taped and timed, and the number of words read correctly were calculated.

Sight word fluency was determined by calculating word efficiency scores for each student on the 120 item sight word test.

General reading fluency was determined by calculating a word efficiency score for each student on the oral reading of the children's literature book.

Reading comprehension was measured in two ways. First, the comprehension section of the Gates McGinitie Reading Test, appropriate for each grade level, was used. Second, five text explicit questions and five text implicit questions were asked after each student completed his oral reading of the children's literature book. The total number of questions answered correctly in each category were calculated, as well as the total number of questions answered correctly.

Procedures

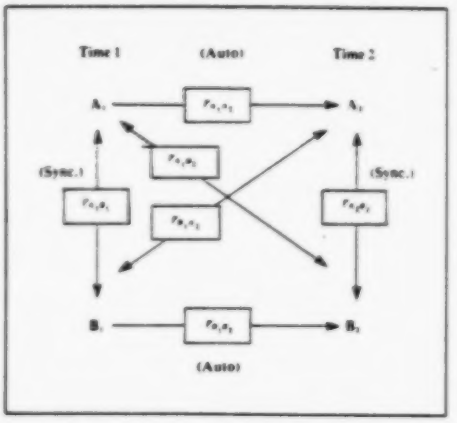
Ninety-five students at each grade level (grades one, two, and three) were randomly selected from each of the six schools that were randomly selected for the study. During the first week in March, graduate students trained to administer the Phonics, Sight Word, Gates-McGinitie, and Oral Reading tests administered them to all of the students involved in the study. Half of the students were given the group phonics test before the individual phonics test, and half were given the individual test first. During the month of November all of the tests were again administered to all of the students under study. Scores for each of the instruments were calculated and entered into the SPSSx for the Macintosh for data analysis.

Data Analysis

After the first data collection, correlations were calculated for the two phonics tests (individual and group) for each grade level, and for the entire group. These correlations were used to examine how the two measures were related, and to validate the group test with the individual test. Raw score means on both tests were compared, section by section, to determine whether or not the production tasks on the individual test were more difficult than the recognition tasks on the group test. Correlations were also calculated for the group phonics test and other reading variables assessed to examine how the test relates to those variables.

After the second data collection, the scores obtained on the group phonics test will be correlated with the group phonics test scores obtained from the first data collection to determine the reliability of the test. At this time the relationships between phonics knowledge and the other reading variables will be analyzed using a cross-lagged panel analysis.

Cross-lagged panel analysis is a quasi-experimental technique designed to explore causal relationships among various variables. For a review of the development of cross-lagged panel analysis and a detailed discussion regarding its assumption, limitations, and interpretation see Cook and Campbell (1979). Cross-lagged panel analysis involves measuring a panel of subjects on two or more variables at two or more points in time. The simplest form of the technique involves measuring two variables at two points in time. This results in four measures and six correlations (see Figure 1).



The correlations between the two different variables measured at the same time (rA1B1 and rA2B2) are called synchronous correlations. The correlations between the same variable measured at different times (rA1A2 and rB1B2) are called auto-correlations, and the correlations between the two different variables measured at two different times (rA1B2 and rB1A2) are called cross-lagged correlations.

Comparing the relative size of the cross-lagged correlations can give an indication of possible causal relationships between the two variables measured. This inference is possible if we make the assumption that cause is temporally antecendent to effect. This assumption means that if variable A is a cause of variable B, then changes in A will produce changes in B, but only after enough time passes for the causal effect to occur. Hypothesized mediating events between A and B produce the time lag. Other things being equal, this causal relationship occurring over time will result in a correlation between variable A at time 1 and variable B at time 2 that is relatively larger than for B at time 1 and A at time 2.

If one of the cross-lagged correlations (rA1B2 or rB1A2) is found to be significantly different from the other, suppose rA1B2 > rB1A2, then according to the logic of this analysis, the inequality indicates that changes in variable A (measured at time 1) are followed by changes in variable B (measured at time 2). If the assumptions of the analysis can be met, this would be an indication that variable A is a cause of variable B. On the other hand, if rB1A2 > rA1B2, then variable B may be inferred to be a cause of variable A. When a significant correlation is observed between the two variables, but there is no significant difference between the cross-lagged correlations, one would conclude that the observed correlation is spurious. A spurious correlation between variables A and B would result if a third factor caused both A and B.

Related Information

First Grade Literature Book: A Bag Full of Pups. Readability 1.0; 279 words; 123 unique words.

Second Grade Book: Peter's Chair. Readability 1.9, 290 words; 152 unique words.

Third Grade Book: Today Was a Terrible Day. Readability 2.8; 677 words; 296 unique words.

Interim Findings

1. Scores obtained from the group phonics test and the individual phonics test were significantly related:

Phonics Test 1	$r = .51, p < .01$
Pnonics Test 2	$r = .79, p < .01$
Phonics Test 3	$r = .83, p < .01$
Total Test	$r = .81, p < .01$

2. A preliminary analysis of the scores obtained from the group phonics test and the individual phonics test suggest that reading pseudowords (production tasks) are more difficult for students than identifying pseudowords when read to them (recognition tasks). The results also offer strength to the argument that both tests are measuring phonics knowledge, but at different levels of understanding. For example, 79 % of the responses of all second grade students were identical on both forms of Test 1; 68% were identical on both forms of Test 2; ande 71% were identical on Test 3. However, between 17% and 25% of their responses were correct on the group test, but incorrect on the individual test (test one 17%; test two 25%; test three 22%). However, some of these differences might

be attributed to lucky "guesses" since it is difficult to make correct guesses on production tasks while it is probably easier to make correct guesses on recognition tasks.

3. Correlations of both phonics test forms suggest that both are significantly related to both word recognition and reading comprehension.

Group phonics and word recognition	$r = .83, p < .01$
Ind. phonics and word recognition	$r = .88, p < .01$
Group phonics and comprehension	$r = .41, p < .01$
Ind. phonics and comprehension	$r = .52, p < .01$

4. Results also suggest that a) phonics knowledge is related to word recognition, fluency of reading, and reading comprehension; b) the ability to read pseudowords accurately and fluently is related to both word recognition and reading comprehension; c) that word recognition is related to reading fluency and reading comprehension; d) that children find it easier to read high frequency--graphophonic regular words than high frequency--graphophonic irregular words, and that low frequency--graphophonic regular words are more difficult for children to read than high frequency--graphophonic irregular words, but easier to read than low frequency--graphophonic irregular words; and e) both phonics knowledge and word recognition abilities develop predictably as children move up through the grades.

Group phonics and story efficiency	$r = .72, p < .01$
Ind. phonics and story efficiency	$r = .78, p < .01$
Group phonics and sight word efficiency	$r = .69, p < .01$
Ind. phonics and sght word efficiency	$r = .75, p < .01$
Pseudoword efficiency and word recognition	$r = .79, p < .01$
Pseudoword efficiency and comprehension	$r = .43, p < .01$
(The highest correlation of any variable to reading comprehension was phonics 1, $r = .58, p < .01$)	
Word recognition and sight word efficiency	$r = .82, p < .01$
Word recognition and story efficiency	$r = .84, p < .01$
Word recognition and comprehension	$r = .51, p < .01$

	Sight 1	Sight 2	Sight 3	Sight 4	Total Sight
Grade one	24	21	10	4.6	60
Grade two	29	27.6	21.5	13.7	92
Grade three	30	29	25.7	18.8	102.7

	Phon 1	Phon 2	Phon 3	Total Phon
Grade one	14	13	11	38
Grade two	18	21	18	57
Grade three	20	24	21	65

	Speed Sight 1	Speed Sight 2	Speed Sight 3	Speed (seconds per word) Sight 4
Grade one	2.2 secs	2.5 secs	4.5 secs	4.7 secs
Grade two	.8 secs	1.1 secs	2.3 secs	2.7 secs
Grade three	.7 secs	.8 secs	1.5 secs	2.0 secs

	Speed Phon 1	Speed Phon 2	Speed Phon 3
Grade one	3.5 secs	4.7 secs	3.8 secs
Grade two	1.8 secs	2.6 secs	1.9 secs
Grade three	1.3 secs	1.9 secs	1.5 secs

	Story Words Efficiency Score	Sight Words Efficiency Score	Phonics Words Efficiency Score
Grade one	.64 (38wpm)	.20(12wpm)	.15(9wpm)
Grade two	1.31(78.6wpm)	.57(34wpm)	.43(25.8wpm)
Grade three	1.81(108.6wpm)	.79(48wpm)	.60(36wpm)

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